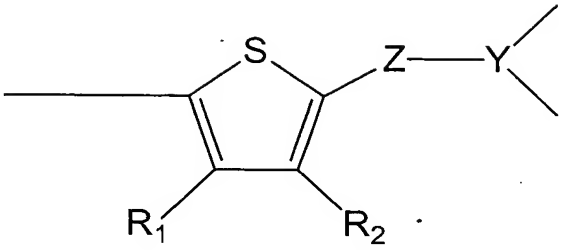
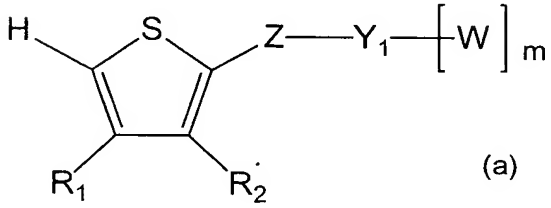
Claims

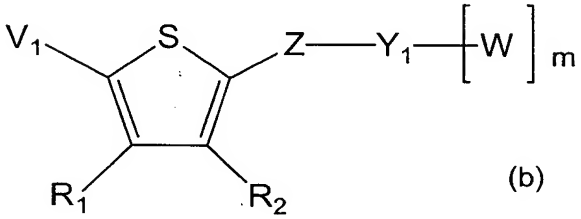
1. A method for producing a dendrimer having a structural repeating unit which is represented by formula (1) and which contains a linear portion including a thienylene moiety and a branch portion Y formed of an optionally substituted trivalent organic group, the method being based on the convergent method, characterized in that the method comprises reaction step 1 of converting α-position hydrogen of the thiophene ring of a thienylene-moiety-containing compound (a) for forming end moieties to an active group V_1 which undergoes Suzuki cross-coupling reaction, to thereby form compound (b); reaction step 2 of subjecting a compound (c) to Suzuki cross-coupling reaction with the compound (b), to thereby yield compound (d), the compound (c) having a linear portion and a branch portion Y and having, at the branch portion Y, two active groups V_2 which undergo Suzuki cross-coupling reaction with the active group V_1; reaction step 3 of converting α-position hydrogen of the thiophene ring of the thus-formed compound to an active group V_1 which undergoes Suzuki cross-coupling reaction, and reacting the compound (c) with the active group V_1, to thereby form a dendron of a subsequent generation; and a step of repeating the reaction step 3 in accordance with needs, to thereby form a dendrimer:



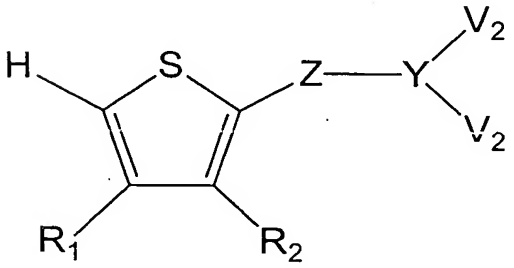
(1)



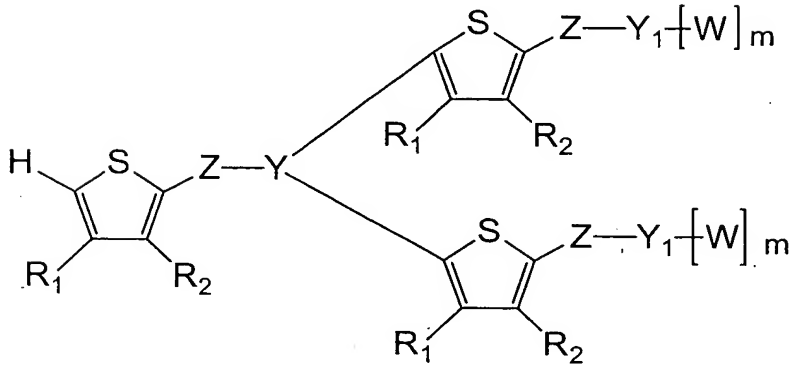
(a)



(b)



(c)



(d)

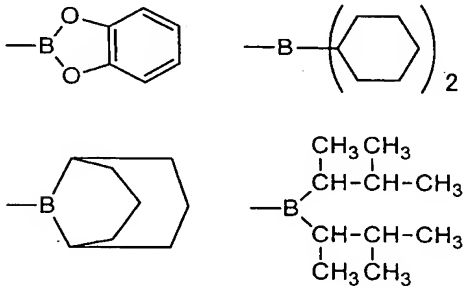
(wherein Z represents a single bond or an optionally substituted divalent organic group having no active group;

each of R_1 and R_2 is selected from among a hydrogen atom, an alkyl group, and an alkoxy group; Y represents an optionally substituted trivalent organic group; Y_1 is identical to Y or represents an organic group having a skeleton identical to that of Y; W may be absent or represents an optionally substituted monovalent organic group having no active group; m is an integer of 0 or more; and each of V_1 and V_2 serving as active groups is selected from active groups which undergo Suzuki cross-coupling reaction, V_1 and V_2 being able to be mutually cross-coupled).

2. A method for producing a dendrimer according to claim 1, wherein the active group V_1 is selected from the following group 1 and the active group V_2 is selected from the following group 2.

Group 1

R = methyl, ethyl, isopropyl, or butyl



group 2

Cl, Br, I, $OSO_2(C_kF_{2k+1})$

K = 1 to 4

3. A method for producing a dendrimer according to claim 1, wherein the active group V_1 is selected from the following group 3 and the active group V_2 is selected from the following group 4.

group 3

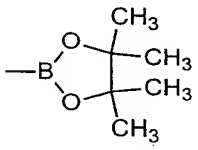
Cl, Br, I

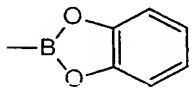
Group 4

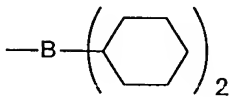
—$B(OH)_2$

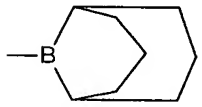
—$B(OR)_2$

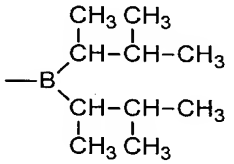
R = methyl, ethyl, isopropyl, or butyl





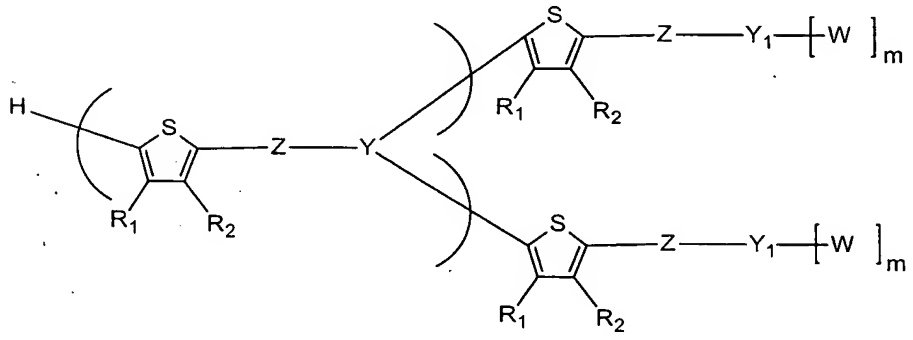




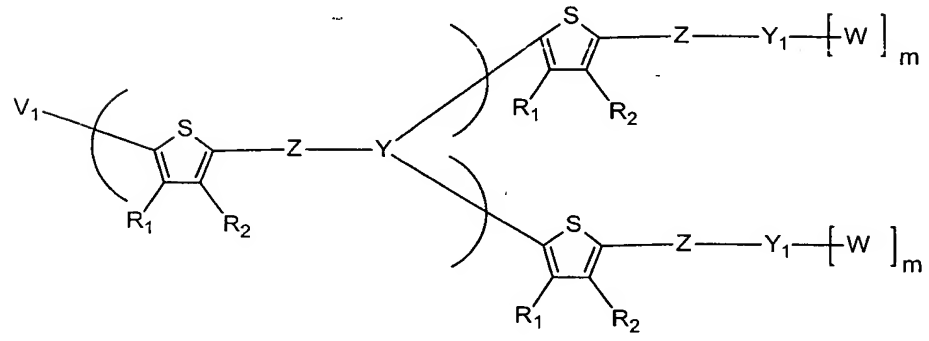


4. A method for producing a dendrimer according to any of claims 1 to 3, wherein, in the case where a compound used in the Suzuki cross-coupling reaction is a thiophene organic boron compound containing boron, the thiophene organic boron compound is gradually added in a continuous or intermittent manner to a reaction system containing the other counterpart compound, thereby performing Suzuki cross-coupling reaction.

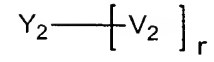
5. A method for producing a dendrimer according to any of claims 1 to 4, which further includes a reaction step of converting α-position hydrogen of the thiophene ring of a compound (e) produced through singly or repeatedly carrying out the reaction step 3 to an active group V_1, to thereby form a compound (f); and a reaction step of reacting the compound (f) with a compound (g) having Y_2 serving as a core, to thereby form a compound represented by formula (2):



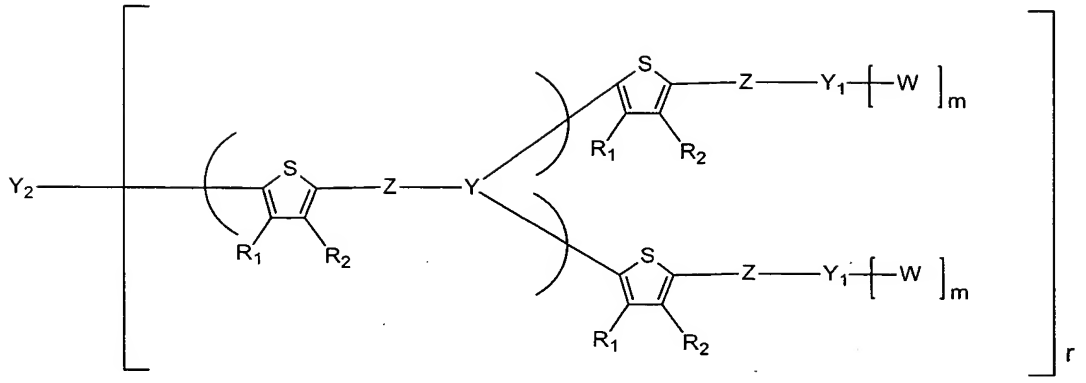
(e)



(f)



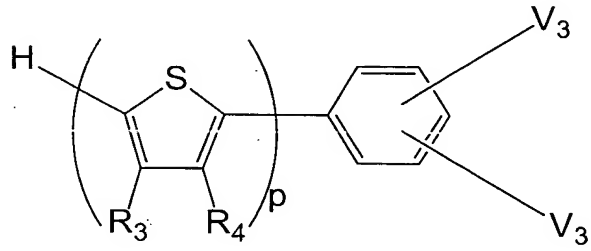
(g)



(2)

(wherein Y_2 represents an r-valent organic group, and r is an integer of 1 or more).

6. A compound serving as a building block employed in a method for producing a dendrimer on the basis of a convergent method, the dendrimer having a structural repeating unit including a thienylene moiety, characterized in that the compound is represented by formula (I-1):



(I-1)

(wherein p is an integer of 1 to 10; each of R_3 and R_4 is selected from among a hydrogen atom, an alkyl group, and an alkoxy group; when p is 2 to 10, R_3 and R_4 in each thienylene structural repeating unit may be different from each other; and V_3 is selected from the following group 5).

Group 5

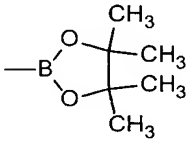
Cl, Br, I, $OSO_2(C_kF_{2k+1})$

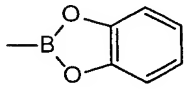
K=1 to 4

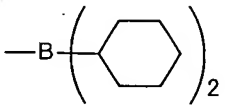
$—B(OH)_2$

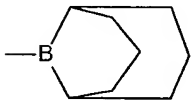
$—B(OR)_2$

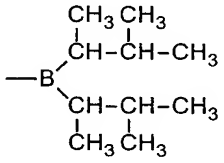
R = methyl, ethyl, isopropyl, or butyl



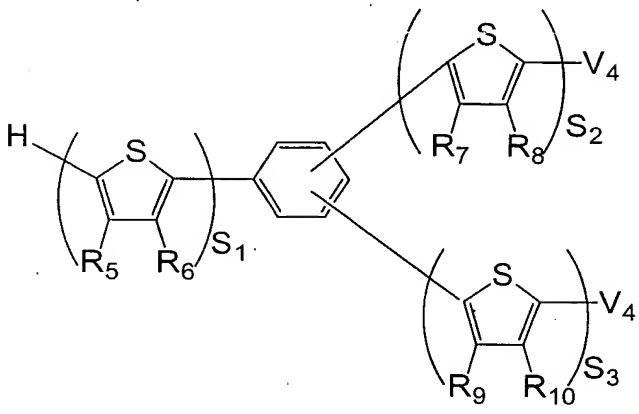








7. A compound characterized by being represented by formula (I-2):



(I-2)

(wherein each of S_1 to S_3, which may be identical to or different from each other, is an integer of 1 to 10; each of R_5 to R_{10} is selected from among a hydrogen atom, an alkyl group, and an alkoxy group, and R_5 to R_{10} in each thienylene

structural repeating unit may be different from one another; and V_4 is selected from the following group 6).

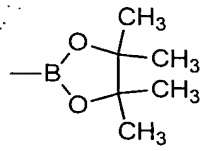
Group 6

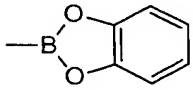
Cl, Br, I

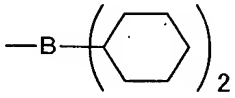
—$B(OH)_2$

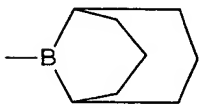
—$B(OR)_2$

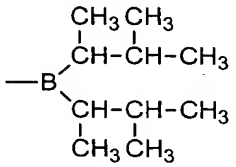
R = methyl, ethyl, isopropyl, or butyl



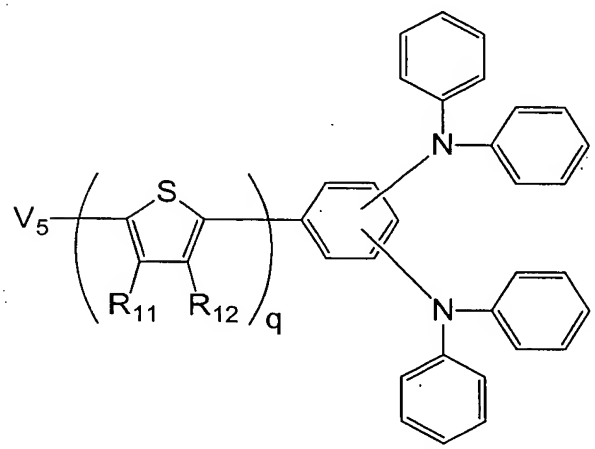








8. A compound characterized by being represented by formula (I-3):



(I-3)

(wherein each of q is an integer of 1 to 10; when q is 2 to 10, R_{11} and R_{12} in each thienylene repeating unit may be different from each other; and V_5 is selected from the

following group 7).

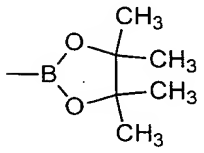
Group 7

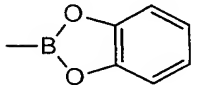
H, Cl, Br, I

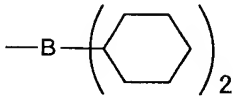
—$B(OH)_2$

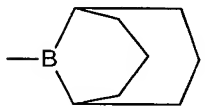
—$B(OR)_2$

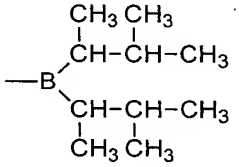
R = methyl, ethyl, isopropyl, or butyl











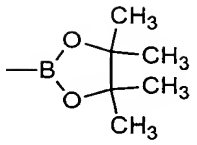
9. A method for producing a thiophene compound comprising performing Suzuki cross-coupling reaction between a thiophene organic boron compound and a reactive compound, to thereby form a thiophene compound, characterized in that the thiophene organic boron compound is gradually added in a continuous or intermittent manner to a reaction system containing the reactive compound, thereby performing Suzuki cross-coupling reaction.

10. A method for producing a thiophene compound according to claim 9, wherein the thiophene organic boron compound has an active group V_6 selected from the following group 1 and the reactive compound has an active group V_7 selected from the following group 2.

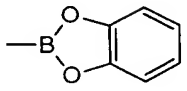
Group 1

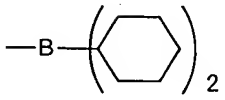
—B(OH)$_2$

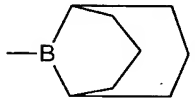
—B(OR)$_2$

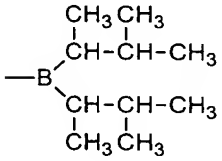


R = methyl, ethyl, isopropyl, or butyl









group 2

Cl, Br, I, $OSO_2(C_kF_{2k+1})$

K = 1 to 4